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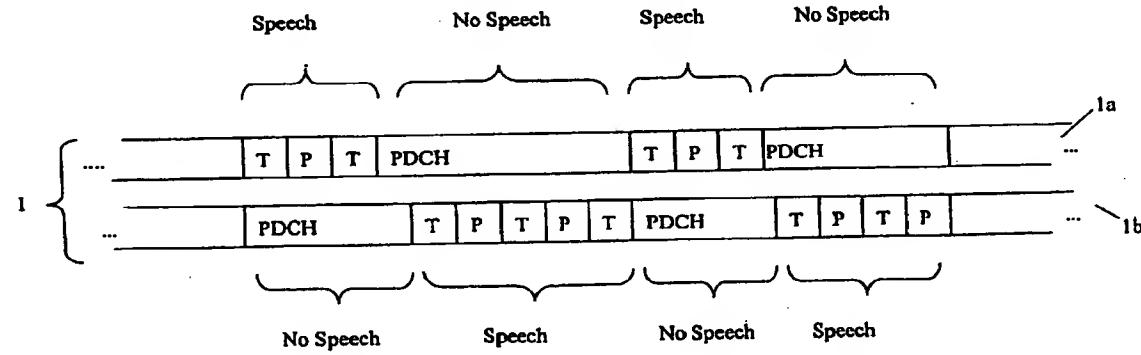
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(54) Title: A METHOD AND DEVICE FOR TRANSMITTING SIGNALS



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(57) Abstract: A method and device for transmitting signals of a first category and signals of a second category over a link, said link providing a predetermined signal transmission rate, where said signals of the first category have a discontinuous characteristic comprising periods of activity and periods of inactivity, where a first channel is provided for carrying signals of the first category and a second channel is provided for carrying signals of the second category, and where the two channels each have respective proportions of the predetermined signal transmission rate of the link during periods of activity of the signals of the first category, and the proportion of the signal transmission rate assigned to the second channel during periods of inactivity of the signals of the first category is increased with respect to the period of activity.

A method and device for transmitting signals

[Field of the Invention]

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The present invention relates to a method and device for transmitting signals of a first category and signals of a second category over a link in a telecommunication system, where said link provides a predetermined signal transmission rate, and where the signals of the first category are associated with a real-time transmission and have a discontinuous characteristic according to which these signals of the first category comprise periods of activity and periods of inactivity. An example of such signals of the first category is speech, and an example of such signals of the second category is data.

[Background of the Invention]

20 In modern communications systems, there exists the situation where it is desirable to transmit signals of two different categories over a link having a predetermined signal transmission rate, i.e. a dedicated or circuit-switched link, and where the first category is prioritized with respect to the second category. An example of this is the simultaneous or parallel transmission of speech and data over a dedicated link, e.g. in a mobile telephone that is capable of transmitting data together with speech, where speech basically has priority over the data transmission, and the data transmission is conducted at best effort. "Best effort" is a transmission category in which there are basically no minimum assurances of band-width, and the corresponding transmission is only conducted as best as possible.

30 The above situation will e.g. occur in a mobile station of a mobile communication system, where only one (physical) channel is available, this one channel e.g. being defined by one time-slot and providing a predetermined signal

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transmission rate, and where this channel should be primarily used for carrying speech information, but it is at the same time desired to transmit data in the background at best effort. This is the case in such mobile communications systems, in which it is desired to add data transmission capabilities to systems that were basically designed for speech communication, as this is presently the case for systems that develop the GSM system further in this respect, such as GERAN (GSM/EDGE Radio Access Network; EDGE = Enhanced Data rates for GSM Evolution).

In connection with speech transmissions, it is known that the periods of speech inactivity can be used advantageously, e.g. to reduce the sending power of a mobile device, in order to save energy. This is also known as discontinuous transmission (DTX). In connection with the simultaneous transmission of speech and data, it is therefore imaginable to define a first channel for carrying speech signals and a second channel for carrying data signals, where the first channel uses the transmission rate of the provided link during periods of speech activity, and the second channel uses the transmission rate during periods of speech inactivity.

Although such a concept would have the advantage that the periods of speech inactivity are advantageously used to transmit data, there occurs a specific disadvantage when the data is transported under the control of a protocol that employs acknowledgment messages for acknowledging the correct receipt of data. The RLC (Radio Link Control) protocol is an example. This shall be explained in connection with Fig. 2.

Fig. 2 schematically shows a bi-directional link 1 that has an up-link direction 1a and a down-link direction 1b. These two link directions will typically show a series of speech activity periods and speech inactivity periods, where it may be remarked that these periods will usually alternate between the up-link and down-link directions, due to the nature of verbal exchange between two partners in a conversation. As indicated in Fig. 2, during periods of speech activity, a

traffic channel (TCH) is assigned the data transmission rate of the link, in order to transmit speech. On the other hand, when there is no speech activity, then the given signal transmission rate of the link 1 is assigned to a packet data channel (PDCH), over which data packets are sent in one direction, and over which acknowledgment messages related to said data packets are sent in the other direction. The concept of ARQ (Automatic Retransmission reQuest) and acknowledgment messages is well known in the art and need not be explained further here.

Under the conditions shown in Fig. 2, the alternating nature of the channel occupation in the up-link and down-link directions can lead to severe stalling problems for data transmission, when sliding-window flow control is used. Sliding-window flow control is again well known in the art, and need not be explained in detail. In sliding-window flow control, the number of packets that is sent depends on the number of outstanding acknowledgments for packets previously sent. In the situation of Fig. 2, if in the direction in which data packets are being sent a period of speech inactivity is very long (which corresponds to a long period of speech activity in the other link direction), then, although data packets could be sent, the flow control will stall, as no acknowledgments can be sent.

As a consequence, the DTX concept leads to the disadvantageous situation that the data transmission in the periods of speech inactivity can become stalled, which means that the data transmission is inefficient and of lesser quality than could be obtained on the basis of the actual data transmission rate available during the periods of speech inactivity. In other words, this means that the available band-width during periods of speech inactivity is not efficiently used.

One possible solution to this problem could consist in stealing frames from the TCH for transporting acknowledgment messages. However, this does not lead to a satisfactory

transmission, as the known speech codecs only allow a very low rate of stolen frames, because otherwise the speech quality is considerably degraded. As a consequence, stolen frames do not provide sufficient transmission capacity for 5 sending acknowledgment messages.

Another solution that may be envisaged is the introduction of a Dual Transfer Mode (DTM), in which the available signal transmission capacity is simply continuously assigned to both 10 the first and second channel. This is schematically shown in Fig. 3. "T" represents the TCH and "P" represents the PDCH. In a TDMA example, as in GSM, where the physical link is provided by a time slot, the channel assignment shown in Fig. 3 could be realized by giving the even numbered time slots to 15 TCH and the odd numbered time slots to PDCH. This in other words means that the traffic channel TCH would be reduced to half-rate (which will also be referred to as TCH/H), where the other half of the transmission rate is assigned to the PDCH.

20 Due to the constant provision of a certain amount of band-width for the PDCH in both directions, the stall conditions mentioned in connection with the DTX concept do not occur. On the other hand, similar to the situation for the DTX concept, 25 there is a waste of transmission capacity during periods of speech inactivity, as a traffic channel for carrying speech is assigned that uses one half of the band-width, although there is no speech to be transmitted in these periods of inactivity.

30 As a consequence, both of the above-discussed concepts, namely DTX in connection with Fig. 2 and DTM in connection with Fig. 3, suffer from the disadvantage that the transmission during periods of speech inactivity becomes 35 inefficient. It may be noted that this problem is not restricted to the above-described example of the simultaneous transmission of speech and data, but will occur in any system that desires to transmit a first and second category of signals over link having a predetermined transmission rate.

where the first category has a discontinuous characteristic comprising periods of activity and periods of inactivity. Besides real-time speech information, this could e.g. also be real-time video information. Also, the signals of the second category do not have to be data as such, but could be any type of information that is suitable for best effort transmission at a lower priority than the first category of signals.

10 [Object of the Invention]

The object of the invention is to provide an improved method and device for transmitting signals of a first category and a second category over a link having a predetermined signal transmission rate, where the signals of the first category have a discontinuous characteristic, such that the above-described problems can be overcome and an efficient transmission can be obtained during periods of inactivity of the signals of the first category.

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[Summary of the Invention]

This object is solved by the method described in claim 1 and the communication device described in claim 12. Advantageous 25 embodiments are described in the dependent claims.

In accordance with the present invention, a first proportion of the signal transmission rate provided by the link is assigned to the first channel and a second proportion is 30 assigned to the second channel during periods of activity of the first category of signals. In other words, during such periods of activity of the signals of the first category, the transmission rate of the link is shared by the two channels. On the other hand, during periods of inactivity, the 35 proportion assigned to the second channel (which carries signals of the second category) is increased with respect to the proportion assigned during periods of activity. Preferably, the second channel receives most or all of the

transmission rate during periods of inactivity of the signals of the first category.

5 This is shown schematically in Fig. 1, which again shows a bi-directional link similar to Figs. 2 and 3. Also, it shows an example where the signals of the first category are speech signals. Also, Fig. 1 shows an example where the TCH and the PDCH share the predetermined transmission rate equally during periods of speech activity (i.e. TCH/H and PDCH at the same 10 rate), and where the link transmission rate is fully allocated to the PDCH during periods of speech inactivity.

15 The concept of the present invention, when applied to the situation where packets of the second category are sent in the one link direction and feed-back packets (such as acknowledgment packets) are sent in the other link direction, as shown in the example Fig. 1, achieves the important advantage that the transmission during periods of inactivity of signals of the first category (speech signals in Fig. 1) 20 becomes highly efficient with respect to the concepts described above in connection with Figs. 2 and 3. Namely, due to the fact that a channel for signals of the second category is provided during periods of activity of the signal of the first category, there is no stalling, because acknowledgment 25 messages can always be sent. In other words, there is no waste of band-width during periods of signal inactivity of signals of the first category due to stalling. Moreover, the periods of inactivity of the signals of the first category are used more efficiently for the second channel in 30 comparison to the example of Fig. 3 (DTM), as the channel assignment for the second channel (PDCH) is increased, and preferably increased to the highest amount possible.

35 This highest amount can be 100%, such that there is no signal transmission over the first channel (TCH) during periods of inactivity of the first signal. According to a preferred embodiment, in which the signals of the first category are real-time speech signals, the first channel is only used for a transmission of background noise during periods of speech

inactivity, where the proportion of the signal transmission rate of the link used by the first channel for transmitting the background noise is lower than the proportion of the transmission rate assigned to the second channel during such periods of speech inactivity. Namely, although it will then not be possible to assign 100 % of the signal transmission capacity to the second channel during the periods of speech inactivity, as a small amount of transmission capacity is required for the transmission of background noise, nonetheless most of the signal transmission rate of the link (more than 90 %) can be assigned to the second channel.

It is possible that the assignment of the first and second channels is performed in principal during an associated mode, regardless of the demand for data transmission. According to another preferred embodiment of the invention, the assignment of transmission capacity to the first and second channel is however only performed if there are signals of the second category to be transmitted. In other words, in the context of an example in which the signals of the first category are speech and the signals of the second category are data, a sharing of the transmission rate between a first channel (TCH) and a second channel (PDCH) is only performed if there is data to be transmitted, whereas if there is no data to be transmitted, then the available transmission rate is assigned fully to the first channel, i.e. the speech channel TCH.

[Brief description of figures]

The present invention shall be better understood from the following description of preferred embodiments, where said description refers to the accompanying figures, in which:

Fig. 1 shows a schematic example of an embodiment of the present invention;

Fig. 2 shows a schematic representation for describing the concept of discontinuous transmission (DTX);

Fig. 3 shows a schematic representation for explaining the concept of dual transfer mode (DTM); and

5 Fig. 4 shows a schematic block diagram for representing an embodiment of a communication device according to the present invention.

[Detailed description]

10 In the following, examples of the present invention shall be explained in detail. The following examples presume that the signals of the first category are speech signals, and the signals of the second category are data signals. The speech signals are transported in frames, as this is well known e.g. from GSM. The data signals are present in the form of data packets arranged in accordance with any suitable data transmission protocol, such as RLP or TCP, this transmission lying at a higher layer than the physical layer that handles the channel assignment for the first and second channels.

20 Although this is a preferred embodiment, the present invention is by no means restricted thereto, as the signals of the first category could e.g. also be real-time video signals, or any other type of signal having a discontinuous characteristic according to which periods of activity and periods of inactivity occur. Also, the signals of the second category can be any type of signal that should be transmitted at best effort parallel to the signals of the first category.

25 Furthermore, the following examples shall relate to mobile communication systems, as the field of mobile communications is a preferred application of the present invention. Namely, the more efficient use of band-width resources is of special importance in mobile communication systems, because band-width is a scarce resource in such systems. However, the present invention is by no means restricted thereto, as it in principle can be applied to any communication system in which signals of a first category and second category as defined in

the claims are to be transmitted over a link of given transmission capacity.

Furthermore, the following examples shall assume that the
5 link is physically defined by way of a time-slot in a TDMA
scheme, such that said time-slot also determines the link
transmission rate. However, it is clear that the link can be
provided in any suitable way, namely also by a frequency
(FDMA), or a code (CDMA), or by any suitable combination of
10 such multiple access concepts.

Fig. 4 shows a schematic block diagram of a communication device according to the present invention, which here is a terminal station of a mobile communication system. Naturally,
15 the present invention can also be implemented in any node of a communication system. The communication device comprises a data source 41, which can e.g. be some sort of data processing application, and it also comprises the basic telephone features of a speech control section 42, which
20 especially contains a codec for coding and decoding speech, where said speech control section 42 is coupled to a microphone 44 and a loudspeaker 43. It may be remarked that other conventional features of a telephone system, such as a keyboard, a display, etc. are not shown in Fig. 4 for the
25 purpose of simplicity.

The communication device figure 4 furthermore comprises a speech discriminator 45, which is adapted to discriminate between periods of speech activity and periods of speech
30 inactivity ("silent" periods, in which the signal from the microphone 44 only contains background noise). The discriminator 45 can operate according to any known principle of speech discrimination as used in the known DTX systems. For example, a combination of threshold comparisons and
35 spectral domain techniques can be employed. As this is well known in the art, it needs not be described further here.

The communication device of Fig. 4 also comprises a channel management part 46 that is arranged to on the one hand

establish channels for transmitting speech signals coming from the speech control section 42 and on the other hand for transmitting data signals coming from the data source 41, over the common link 1, which is a bi-directional link as 5 shown in Fig. 1.

It may be noted that the channel management part will on the one hand establish the channels, and on the other hand perform the assignment of transmission rate to established 10 channels. In other words, if a channel is not established, then no assignment can take place. The present invention is preferably implemented in such a way that once an appropriate operation mode is entered, e.g. as selected by the user, the channel management part will establish the first and second 15 channel. When this mode is terminated, then the channels as defined in accordance with the invention are also terminated.

According to a first embodiment, the communication device of Fig. 4 is operated in such a way that the assignment of 20 transmission rate provided for the link 1 is conducted as exemplified in Fig. 1. Namely, the channel management part 46 and the node at the other end of link 1 (e.g. a base station sub-system BSS in the case of a GSM communication system) are controlled such that during periods of speech activity 25 detected by discriminator 45, the transmission capacity of link 1 is assigned to both the traffic channel TCH for carrying speech signals and the packet data channel PDCH for carrying data signals. It may be noted that although Fig. 1 only shows two channels, the present invention is also 30 applicable to more than two channels.

On the other hand, during periods of speech inactivity, the proportion of transmission rate assigned to the data transmission channel PDCH is increased with respect to the 35 proportion during speech periods. In the example of Fig. 1, the entire transmission rate is assigned to the data transmission channel PDCH. In this case there would be no transmission of background noise during the periods of speech inactivity. In this case it is e.g. possible that the two

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terminal stations involved in the communication are arranged to create comfort noise during these periods of speech inactivity. It is, however, also possible to arrange the channel assignment during periods of speech inactivity in such a way that a large portion of the transmission rate is used by the data transmission channel PDCH, and only a small part is used by the TCH for transmitting background noise (e.g. > 90 % to the PDCH and < 10 % to the TCH).

10 It is in principle possible that the assignment of data transmission rate to the speech channel TCH and the data channel PDCH is variable during the periods of speech activity. This depends on the specific requirements of the individual system, and can e.g. also depend on factors such as supplementary channels (i.e. the case where more than the two channels TCH and PDCH are provided), etc. It is, however, preferable that the assignment during periods of speech activity is in a fixed proportion, e.g. 1/4 to the data channel PDCH and 3/4 to the traffic channel TCH. Such a fixed proportionality has the advantage of easier maintenance. More preferably, the two channels share the data transmission rate at 1/2 each. In other words, in the context of a GSM system, the traffic channel becomes a half-rate traffic channel TCH/H as is already well known for GSM half-rate systems, and the other half of the transmission rate provided by the link is assigned to the packet data channel PDCH. In other words, the TCH/H corresponds to a half-assigned time-slot, where every second burst is assigned, while the PDCH is equally a half-assigned time-slot in which every other second burst is assigned. On the other hand, during periods of speech inactivity, if the whole transmission rate is assigned to the PDCH, during these periods the PDCH is assigned every burst to thereby fully use the time-slot.

35 It may be noted that typically the channel management part 46 will instruct the codec in speech control section 42 to switch to lower rate coding (e.g. half-rate coding) of speech if the concept of Fig. 1 is used.

According to the presently described first embodiment, the channel assignment during periods of speech activity is performed regardless of the presence or absence of data packets to be transmitted. The advantage is the simplicity of the control scheme. Namely, if the communication device is operated to enter a mode in which the concept of the present invention is applied, then the channel assignment as indicated in Fig. 1 is automatically activated. The disadvantage is that band-width is assigned to the data transmission channel, even if no data is present, such that said band-width could be used for enhancing the speech transmission over the traffic channel TCH.

Therefore, in accordance with a second embodiment, the channel assignment as shown in Fig. 1 is only performed in the presence of data to be transmitted. In other words, if the data source 41 indicates to the channel managing part 46 that there is a demand for data transmission, then the channel management part 46 performs the assignment to thereby create the situation as shown in Fig. 1. On the other hand, if there is no demand for data transmission, then the channel management part 46 assigns the full transmission rate to the traffic channel, i.e. assigns a TCH/F. It may be noted that the operation during periods of speech inactivity and in the absence of data packets to be transmitted can be handled in any desired way. For example, the known DTX operation of reducing the sending power during periods of speech inactivity can be invoked, in order to save battery capacity, or alternatively the packet data channel PDCH can be assigned during the period of speech inactivity, such that if a demand for data transmission appears during the period of speech inactivity, a transmission can immediately commence.

In summary, in both the first and second embodiment, at least if there is data to be transmitted, the available transmission rate of the link is shared between the speech channel or traffic channel TCH and the packet data channel PDCH during periods of speech activity, and the proportion of data transmission rate assigned to the PDCH is increased

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during periods of speech inactivity. As already specified earlier, this concept is especially advantageous in connection with bi-directional links, in which the data signals carried by the PDCH are in the one link direction 5 data packets, and in the other link direction feed-back packets related to the received data packets, e.g. acknowledgment messages in the context of an ARQ scheme. There are numerous protocols that make use of feed-back 10 packets for controlling the flow of data packets, such as RLC (Radio Link Control) or also TCP (Transmission Control Protocol). Both the RLC protocol and the TCP protocol are well known in the art and well described in corresponding specifications, such that a further description is not necessary here.

15

It may be noted that it is of no importance how the protocol using feed-back packets is implemented or arranged, e.g. if the acknowledgment packets are sent automatically or if they 20 are only sent in response to a polling message from the data packet sender.

In any case, in accordance with the present invention, there is always a packet data channel PDCH present, even in periods 25 of speech activity, such that feed-back packets can always be sent, such that no stalling will occur, so that the periods of speech inactivity can be efficiently used. In other words, the present invention provides an effect not provable by the system described in connection with Fig. 2. Also, the present invention provides an effect not attainable by the 30 system of Fig. 3, because in Fig. 3 there is a waste of transmission capacity for the traffic channel in those periods, in which there is no speech. Therefore, in summary, the system of the present invention achieves the effect not achievable by either the system of Fig. 2 or of Fig. 3.

35

The identification of the assigned channel type by the receiving end of link 1 can be done in any desired or suitable way, e.g. by means of appropriate headers in frames. In accordance with a preferred example of the present

invention, which relates to a GSM based system that additionally employs the definitions of GPRS (General Packet Radio Service) for data transport, the so-called stealing bits of the physical layer frame are used for identifying the assigned channel. This can be used in the up-link as well as the down-link direction. The stealing bits are starting bits provided by a burst that are not coded together with the payload. For example, the first two bits are not coded with the payload. Over the course of several bursts such stealing bits code information about the content of these bursts. For example, in GPRS four bursts form one radio block, such that eight stealing bits are available for indicating which coding for the payload has been used.

An example of how the two channels and the corresponding data transmission rate can be assigned will now be described. The transmitter is arranged such that each link direction transports a series of frames, where RLC PDUs (PDU = Protocol Data Unit) and voice frames alternate. The RLC PDUs carry data. The voice frames carry speech during periods of speech activity, and carry data during periods of speech inactivity, to thereby achieve the concept shown in Fig. 1. In other words, the channel management part simply places data into the voice frames during periods of speech inactivity, and changes the stolen bit(s) in the voice frame, such that the receiver will correctly identify the frame as carrying data.

On the other hand, in the above mentioned second embodiment, it is possible that during periods of speech activity in which no data is to be transported, the channel management part will place voice signals into the RLC PDUs, and also accordingly set the stolen bit(s), such that the receiver may correctly identify the payload of the PDU.

In such a combined GSM/GPRS system, the traffic channel TCH will not only carry the speech signals, but also the other known associated virtual channels for transporting control information, such as the FACCH (Fast Associated Control Channel), the SACCH (Slow Associated Control Channel), etc.

and the data packet channel PDCH will also carry the known associated GPRS virtual channels, such as the PACCH (Packet Associated Control Channel).

- 5 With respect to the above-mentioned preferred example of a GSM/GPRS system, it may be noted that although GPRS is oriented towards packet-switching (i.e. connectionless), the situation underlying the present invention is such that a link with a predetermined data transmission rate is present,
- 10 10 i.e. a dedicated circuit-switched link. For this reason, even if data is being sent in accordance with protocols and standards established in connection with GPRS, then specific simplifications can be employed. Namely, in GPRS a so-called temporary block flow (TBF) is assigned every time that data
- 15 15 is to be sent. This is due to the connectionless concept underlying GPRS. The TBF includes assigned resources (such as a time-slot) as well as established RLC entities. Due to the fact that in the situation underlying the present invention the data is being sent over a circuit-switched link, it is
- 20 20 not necessary to generate a TBF for every data transmission. Much rather, it is sufficient to establish a virtual TBF (which could also be referred to as a "permanent" TBF) when the combined channel consisting of a TCH and a PDCH is established, and this virtual TBF shall only be terminated
- 25 25 when the combined channel is released, namely when the communication switches to a mode in which the concept of the present invention is not used.

30 Although the present application has been described in the context of specific examples, these examples are only intended to provide the skilled person with a better understanding and are not intended to restrict the scope of the invention. The scope of the invention is much rather defined by the appended claims. Also, reference signs in the 35 claims only serve the purpose of better understanding and do not restrict the scope.

[Claims]

1. A method of transmitting signals of a first category and
5 signals of a second category over a link (1) in a
telecommunication system, said link providing a
predetermined signal transmission rate, where said
signals of the first category are associated with a
real-time transmission and have a discontinuous
10 characteristic according to which said signals of said
first category comprise periods of activity and periods
of inactivity, said method comprising:

15 providing a first channel (TCH) for carrying signals of
said first category and providing a second channel
(PDCH) for carrying signals of said second category,

20 assigning a first proportion of said predetermined
signal transmission rate to said first channel (TCH) and
a second proportion of said predetermined signal
transmission rate to said second channel (PDCH) during
periods of activity of said signals of said first
category, and

25 increasing the proportion of said predetermined signal
transmission rate assigned to said second channel (PDCH)
during periods of inactivity of said signals of said
first category.

30 2. The method of claim 1, wherein during periods of
activity of said signals of said first category the
first and second channel each use a fixed proportion of
the predetermined signal transmission rate.

35 3. The method of claim 2, wherein during periods of
activity of said signals of said first category the
first and second channel each use a one half of the
predetermined signal transmission rate.

4. The method of one of claims 1 to 3, wherein said signals of said first category are real-time speech signals.
5. The method of claim 4, wherein during periods of speech inactivity said first channel is only used for a transmission of background noise, where the proportion of said predetermined signal transmission rate used by said first channel for transmitting background noise during periods of speech inactivity is lower than the proportion of said predetermined signal transmission rate used by said second channel.
10. The method of one of claims 1 to 3, wherein said signals of said first category are real-time video signals.
15. The method of one of claims 1 to 6, wherein said signals of said second category are non-real-time data packets sent from a first end of said link to a second end, and acknowledgment packets for acknowledging the correct receipt of a data packet, said acknowledgment packets being sent from said second end to said first end.
20. The method of one of claims 1 to 7, wherein said link is established between a terminal station and a node of said telecommunication system.
25. The method of claim 8, wherein said telecommunication system is a mobile communication system and said terminal station is a mobile station.
30. The method of one of claims 1 to 9, wherein said step of assigning first and second proportions of said predetermined signal transmission rate to said first channel (TCH) and said second channel (PDCH) during periods of activity of said signals of said first category is only invoked if there are signals of said second category present that are to be transmitted, such that in the absence of signals of said second category to be transmitted and during periods of activity of said

signals of said first category said predetermined signal transmission rate is assigned fully to said first channel (TCH).

5 11. - The method of claim 1, wherein said link is a bi-directional link having a first direction and a second direction, said signals of said second category consist of data packets to be sent in the first direction and acknowledgment packets to be sent in the second direction, and said first and second channels are provided at least in said second direction.

10 12. A communication device, said communication device being operable to transmit signals of a first category and signals of a second category over a link in a telecommunication system, said link providing a predetermined signal transmission rate, where said signals of the first category are associated with a real-time transmission and have a discontinuous characteristic according to which said signals of said first category comprise periods of activity and periods of inactivity, said communication device comprising:

15 a channel establishment part (46) arranged to provide a first channel (TCH) for carrying signals of said first category and a second channel (PDCH) for carrying signals of said second category,

20 a discriminator (45) for discriminating between periods of activity and periods of inactivity of said signals of said first category, and

25 a channel management part (46) arranged to communicate with said discriminator, said channel management part being operable to assign a first proportion of said predetermined signal transmission rate to said first channel (TCH) and a second proportion of said predetermined signal transmission rate to said second channel (PDCH) during periods of activity of said

signals of said first category indicated by said speech discriminator, and to increase the proportion of said predetermined signal transmission rate assigned to said second channel (PDCH) during periods of inactivity of said signals of said first category indicated by said speech discriminator.

- 5 13. The communication device of claim 13, wherein said channel management part is arranged such that during periods of activity of said signals of said first category the first and second channel each use a fixed proportion of the predetermined signal transmission rate.
- 10 14. The communication device of claim 13, wherein said channel management part is arranged such that during periods of activity of said signals of said first category the first and second channel each use one half of the predetermined signal transmission rate.
- 15 15. The communication device of one of claims 12 to 14, wherein said signals of said first category are real-time speech signals.
- 20 16. The communication device of claim 15, wherein said channel management part is arranged such that during periods of speech inactivity said first channel is only used for a transmission of background noise, where the proportion of said predetermined signal transmission rate assigned to said first channel for transmitting background noise during periods of speech inactivity is lower than the proportion of said predetermined signal transmission rate assigned to said second channel.
- 25 17. The communication device of one of claims 12 to 14, wherein said signals of said first category are real-time video signals.

20

18. The communication device of one of claims 12 to 17, wherein said signals of said second category are non-real-time data packets sent by said communication device over said link, or acknowledgment packets for acknowledging the correct receipt of a data packet received by said communication device over said link.

5 19. The communication device of one of claims 12 to 18, wherein said communication device is a terminal station 10 of said telecommunication system.

10 20. The communication device of claim 19, wherein said telecommunication system is a mobile communication system and said terminal station is a mobile station.

15 21. The communication device of one of claims 12 to 20, wherein said channel management part is arranged such that said assigning of first and second proportions of said predetermined signal transmission rate to said

20 first channel (TCH) and said second channel (PDCH) during periods of activity of said signals of said first category is only conducted if there are signals of said second category present that are to be transmitted, such that in the absence of signals of said second category 25 to be transmitted and during periods of activity of said signals of said first category said predetermined signal transmission rate is assigned fully to said first channel (TCH).

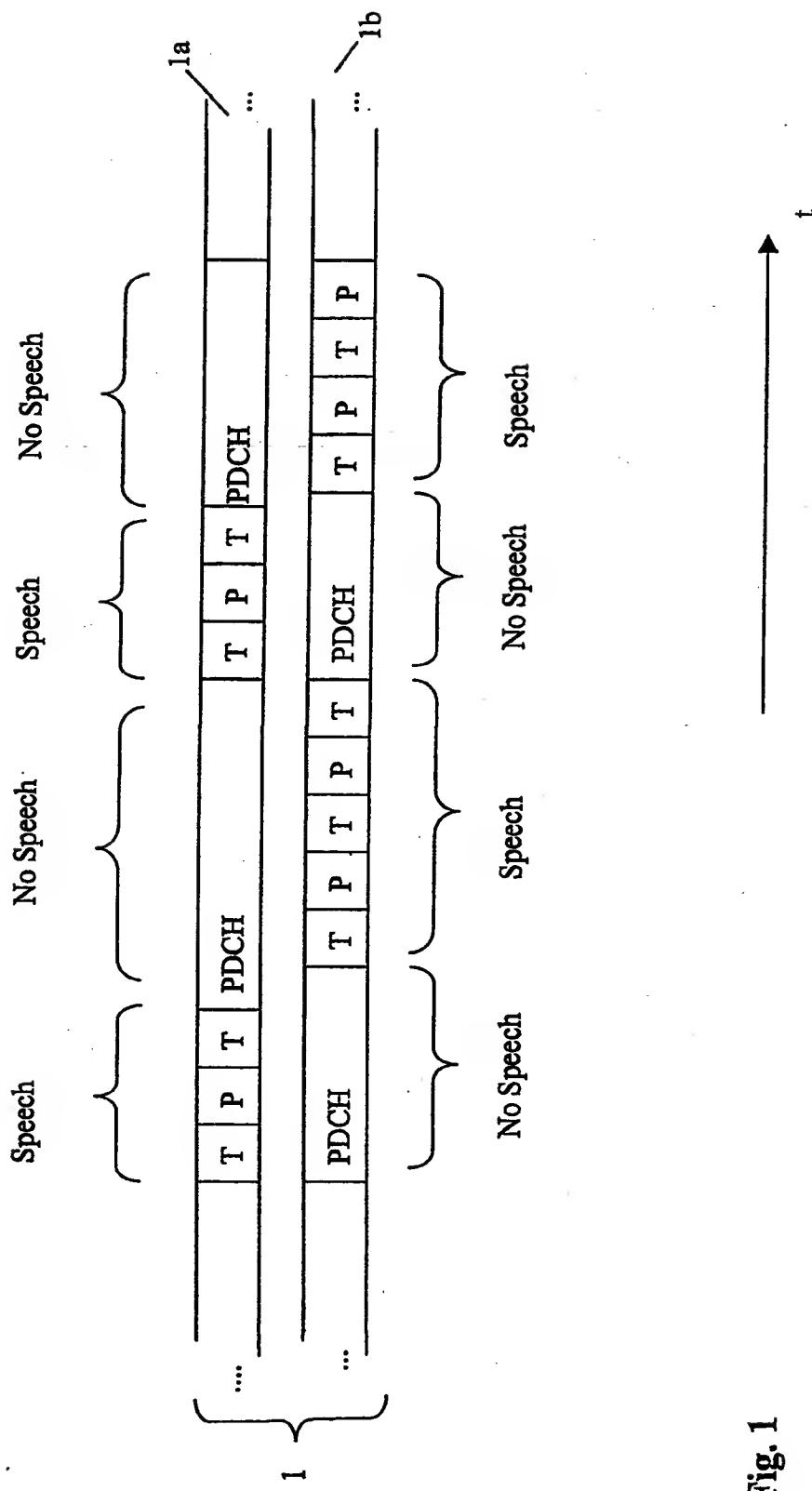


Fig. 1

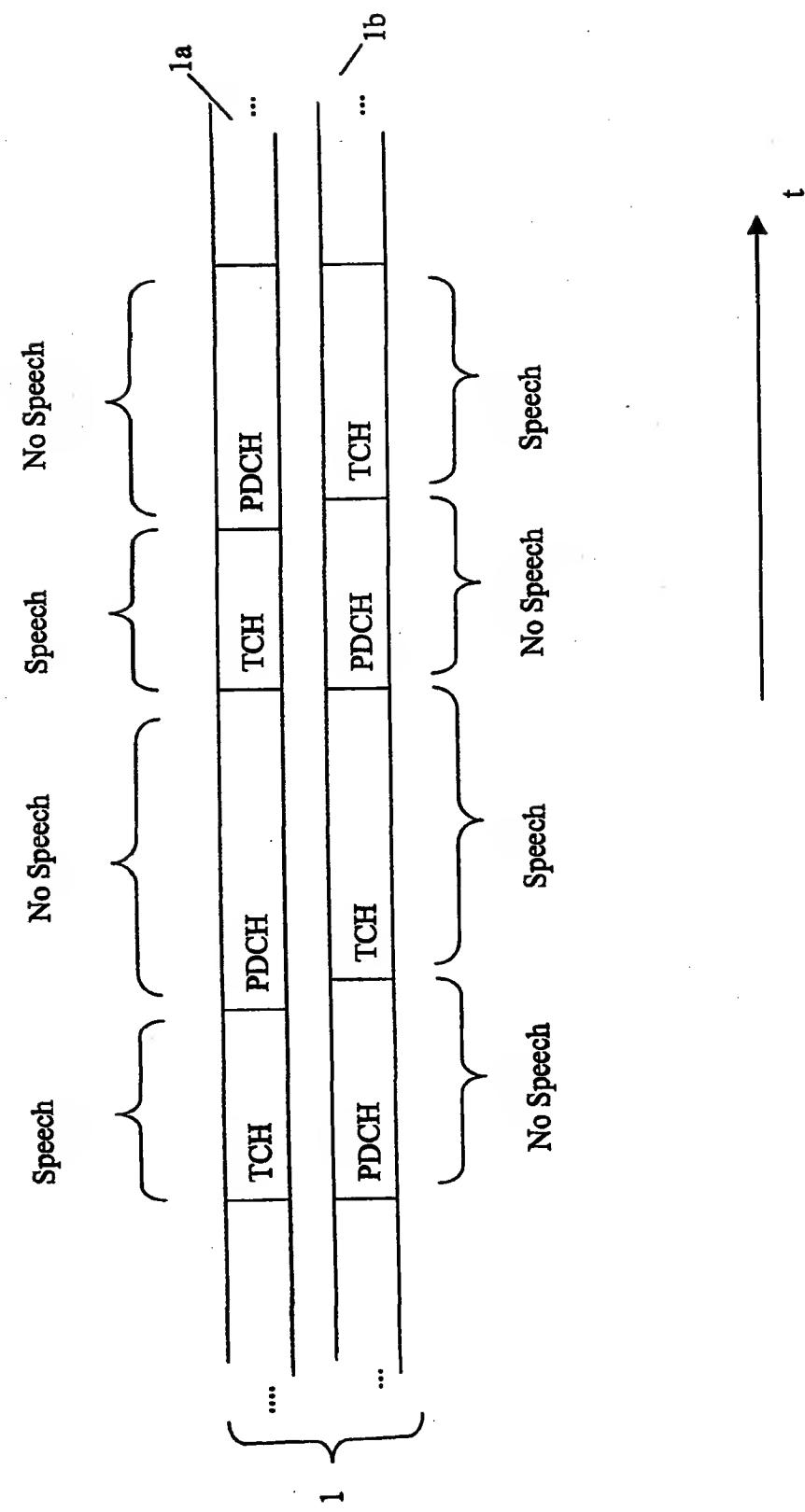


Fig. 2

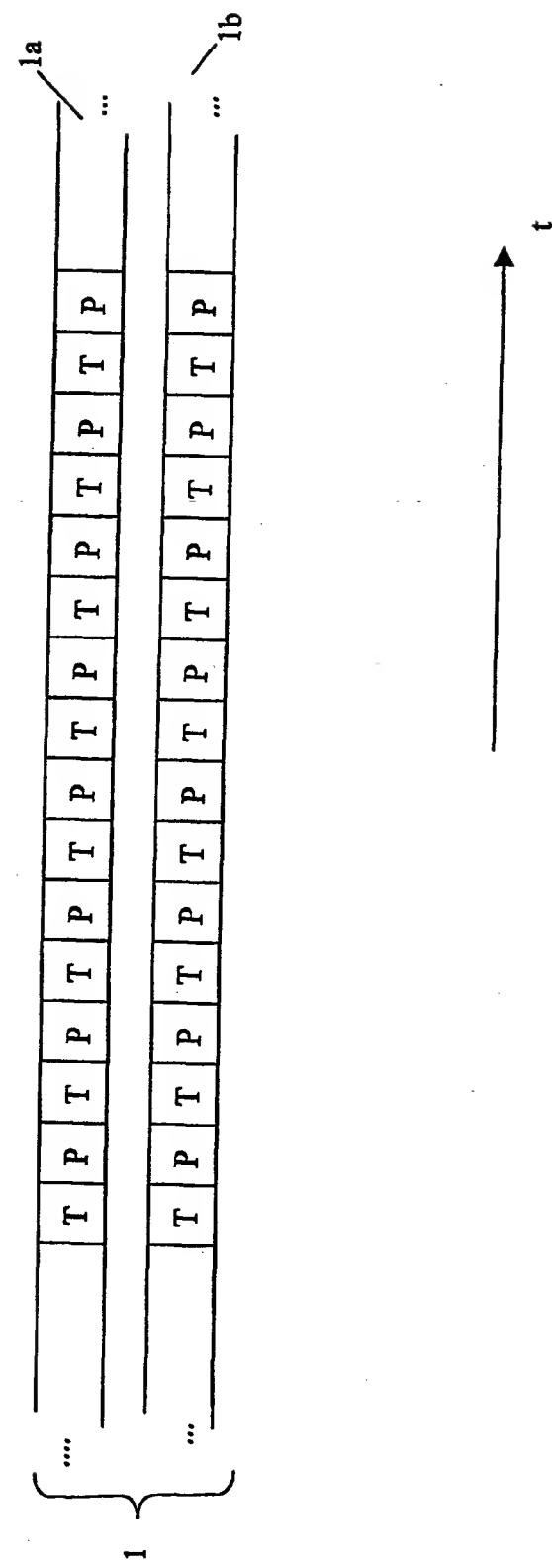


Fig. 3

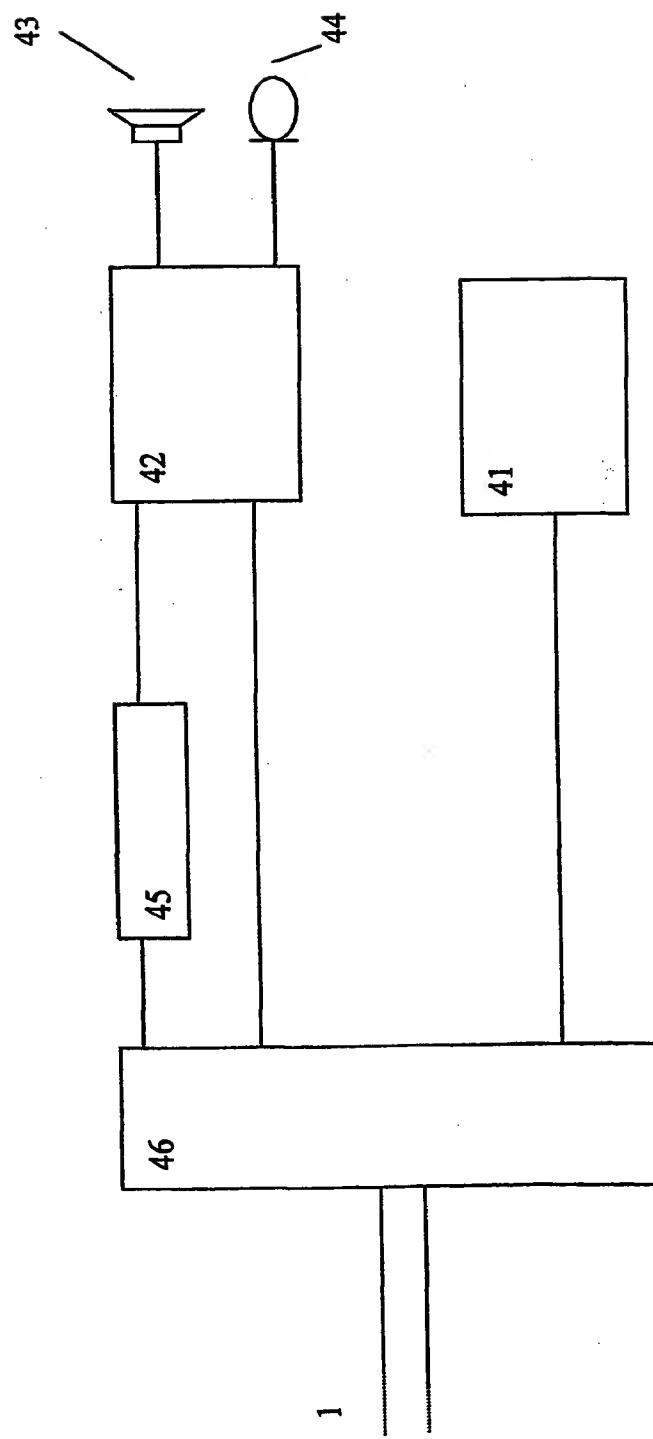


Fig. 4

INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 01/08853

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H04L12/64

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 757 801 A (ARIMILLI HARINARAYANA) 26 May 1998 (1998-05-26)	1,4,5,7, 8,10-12, 15,16, 18,19,21 9,20
A	abstract figures 3,4A-1,5A column 3, line 1 - line 22 column 7, line 10 - line 17 column 12, line 32 - line 40 column 17, line 6 - line 30 column 24, line 1 -column 26, line 16 column 28, line 30 -column 30, line 45 ---- -/-	

 Further documents are listed in the continuation of box C. Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
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- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the International filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- "&" document member of the same patent family

Date of the actual completion of the International search

8 November 2001

Date of mailing of the International search report

15/11/2001

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 01/08853

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>TRAN H ET AL: "RANDOM ACCESS WITH MIXED VOICE AND DATA WITH INTERPOLATION OF DATA IN SPEECH" PROCEEDINGS OF THE GLOBAL TELECOMMUNICATIONS CONFERENCE (GLOBECOM), US, NEW YORK, IEEE, vol. -, 29 November 1993 (1993-11-29), pages 113-117, XP000428416 abstract page 113, column 1, paragraph I page 113, paragraph II.A -page 114</p>	1,12
A	<p>BOCCI P ET AL: "DYNAMIC DATA PACKET SIZING BASED ON REAL TIME MONITORING OF SYSTEM VOICE ACTIVITY" MOTOROLA TECHNICAL DEVELOPMENTS, US, MOTOROLA INC. SCHAUMBURG, ILLINOIS, vol. 31, 1 June 1997 (1997-06-01), page 172 XP000741064 entire doc</p>	9,20

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP 01/08853

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US 5757801	A 26-05-1998	US 5682386	A	28-10-1997
		AT 196708	T	15-10-2000
		CA 2188171	A1	02-11-1995
		DE 69518980	D1	02-11-2000
		DE 69518980	T2	15-03-2001
		EP 0756796	A1	05-02-1997
		EP 0998092	A2	03-05-2000
		JP 3193054	B2	30-07-2001
		JP 9512402	T	09-12-1997
		WO 9529576	A2	02-11-1995
		WO 9615601	A2	23-05-1996
		US 6275502	B1	14-08-2001
		US 6151333	A	21-11-2000